

MONTANA TEEN DRIVER CURRICULUM 2.0 GUIDE

Module 5.3 – Protecting Occupants - Lesson Plan

Protecting Occupants Lesson Objective *(from Essential Knowledge and Skills Topics):*

The student is expected to:

- (a) describe the three collisions of a crash and the effect on the restrained and unrestrained human body;
- (b) identify and describe locations and purpose of airbags, belt adjusters, and head restraints and demonstrate proper adjustments and operation to provide crash survival protection for adults;
- (c) identify how child restraint systems operate (infants, forward-facing, booster seats and lap shoulder devices), proper positioning within a vehicle and how they provide crash survival protection; and
- (d) demonstrate proper steering wheel adjustments to accommodate for airbags.

Materials Needed:

- 1. Module 5.3 PowerPoint Presentation
- 2. Module 5.3 Fact Sheets (printed for each student)
- 3. Module 5.3 Lesson Plan/Teacher Commentary (printed out)

TEACHER COMMENTARY

The following are questions you can ask during the presentation to engage students and have them develop key concepts related to Protecting Occupants.

Representation of the module slides are provided to allow you to connect the materials, data, and questions with the presentation.

Slide 2:

This presentation is about how our bodies behave in a crash and how we can manage the forces of natural laws using a vehicle's safety features.

The key here is that our bodies have kinetic energy when the car is moving because we are moving at the same speed as the car. It has momentum and it has the characteristic property of inertia and mass.

When the car turns, our body would continue on in a straight line except that the seat or door redirects our energy and keeps it moving in the same direction of the car.

When the car comes to a sudden stop our body continues forward and would keep going except for restraint systems which hold us in the seat.

Just Like Cars, Our Bodies
Obey Natural Laws

Slide 3 – Student Activity 1

You can have some fun with this. Instead of having the students share their list as a list they could make up a pantomime of the device or design and share it that way. They could act it out or play Pictionary to have the others guess. You can be pretty creative with this.

Vehicle Design**Safety Belts****Safety Belt Pretensioner****Head Restraints****Anti-Submarine Bars in the front seat****Airbags-Frontal, Side Impact, Side Impact curtains****Crumple zones around the car****Bucket seats with side bolster****Knee bolsters under the dash****Student Activity 1**

- Work in discussion groups of 2 or 3
- Identify how cars are designed to protect occupants—What features do they have to manage forces in the event of a crash?
- Make a list and share it with the class.

Slide 4 – Student Activity 1

These three collisions occur in every crash. Safety equipment designed into the vehicle minimizes the second and third crashes to prevent bodily injury. The purpose of this module is to help students understand that safety equipment is there to help manage the natural laws and forces in a crash that otherwise would kill or maim them. This should not turn into a discussion about personal liberties but about how they can responsibly manage the natural laws they will always encounter in a motor vehicle.

Three Collisions in Every Crash

- The Vehicle
- The Body
- The Internal Organs

Slide 5 – The First Collision – Vehicle Crash

The *first collision* is the vehicle collision.

The vehicle begins stopping as it collides with another object. The time from crash to full stop in a 30-mph crash is about one-tenth of a second.

As the vehicle slows, the front of the vehicle crushes, taking some of the energy of the crash and prolonging the time it takes to come to a stop.

**The First Collision:
Vehicle Crash**

- Sudden deceleration
- Short duration-0.1 seconds
- Vehicle crumples to absorb energy of crash



Click on image to start video.



Slide 6 – The Second Collision – Occupant Striking Objects

The *second collision* is the human collision.

In the human collision, the occupant continues to move toward the point of impact at the same speed even though the vehicle begins to stop once impact occurs.

The occupant will begin to stop once he or she connects with an outside force.

An unrestrained occupant will hit the inside of the vehicle, such as a window or other object in the path of motion.

As that individual collides with the vehicle interior, he or she slows down from 30 mph to a stop in a few hundredths of a second, with only the body to absorb the energy of the crash.

For a restrained occupant, however, the outside force will be met by a seat belt or the harness of a CR. The forces are distributed over the belt and the airbag and it reduces the force of impact to levels that are manageable by most bodies.

Questions to ask students

1. Do you have time to brace for impact in a crash?
2. Do you have the strength to keep from crashing into the steering wheel and windshield?
3. Describe the injuries that might occur when you crash into something like the steering wheel and windshield.

Some students will share that they have a great uncle who is alive because he was thrown from the car in a crash. Unfortunately these few stories are used to justify not wearing a seat belt. This is not the time to tell them that their relative got lucky. It is the time to suggest that it is a rare occasion for someone to survive being thrown from a vehicle and that the only sure way to manage the tremendous forces in a crash is with seat belts and airbags.



Click on image to start video.

We aren't strong enough.

We aren't quick enough

And we don't always see it coming.

Slide 7 – Belted vs. Unbelted

Watch the animations and then determine which one has the better chance of surviving this low speed crash.

Questions:

Where is the second crash occurring for the belted passenger? Where are the forces being applied on his body?

The crash is occurring at the extend of the seat belt. The forces are being distributed along the entire length of the seat belt taking what would be approximately 2000 lbs of force and applying it in 10 to 20 locations along the belt. Your body can manage 200 lbs of force in multiple locations along his chest and abdomen. It usually does not do so with 2000 lbs of force in one or two locations.

Where is the second crash happening with the unbelted passenger? Where are the forces being applied on his body? Where does he end up at the end of the crash?

The forces are being applied at the neck and chest striking the steering wheel and windshield. Your body does not have the ability to deal with that kind of force at impact and often times will cause extensive injuries or death.

- Fractures and compression (squeezing) injuries to the chest (and subsequent bruising of the heart) and abdomen.
- Cuts and fractures to the eyes, face, and throat.
- Spinal injury and possible paralysis.
- Skull fracture and brain injury.



Click on images for animation.

Slide 8 – Did you know?

There is a lot of discussion amongst teens that they know of a distant relative who is alive today because they weren't wearing their seatbelt in a crash. The risk of injury is substantially higher for unbelted passengers and data bears that out. Students and parents choose to use anecdotal evidence to justify not wearing a safety belt.



Slide 9 – What about Airbags?

You may wish to follow this link to learn more about airbags: <http://www.iihs.org/research/ganda/airbags.aspx>

The key to experience the maximum benefit of the vehicle airbag system is to be held in place by your safety belt. While airbags by themselves can stop you, they inflate quickly and deflate quickly. They also deploy in only one direction. If you strike an object at an angle you will find that you may miss the airbag and strike a solid surface that can cause injury.



Slide 10 – What about Airbags and No Belt

Notice as the head strikes the airbag the neck and head hyperextend which would cause injury to the head and neck even though the airbag activated. The airbag is an **ADDITIONAL** safety restraint that is most effective when used in combination with the seat belt.



Click on image to start video.

Slide 11 – The Third Collision – Internal Organs

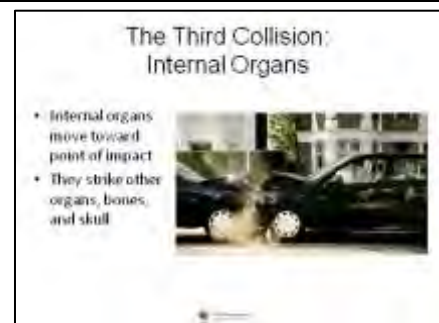
The *third collision* is the internal collision.

In the internal collision, the occupant's internal organs move toward the point of impact and hit other organs, bones, and the skull.

Even though the body may appear uninjured, the liver, spleen, heart, or other organs may be torn, bruised, and/or caused to bleed.

Impacts to the head may cause "closed head injuries" resulting from the soft tissue of the brain hitting the skull or being torn as the skull fractures.

For a better discussion on the three collisions you may want to check out *When Physics Meets Biology* with Dr. Griff Jones produced by the IIHS. It has some great points and talks in depth on the issues of natural laws and the body's response to them. <http://education.ufl.edu/gjones/>



Click on image to start video.



Slide 12 – The Backseat Bullet

Most teens think that if they are in the back seat that they don't need to buckle up. It is a habit that may cost them more than they think. Often the passenger in the back can be the cause of multiple injuries in a crash. Remember the second crash. The passenger in the back will move forward at the original speed of the vehicle until it strikes something such as the heads of the belted passengers.

The responsibility of making sure that everyone is buckled is that of the driver. It is not bad that each of the car's occupants should ask, but ultimately the person putting the car in motion has the responsibility of ensuring the safety of every occupant.

Questions you may want to ask:

1. Who needs to make sure that everyone in the car is buckled?
2. What should the driver do if people are not buckled?

Everyone Needs to Buckle Up



Click on image to start video.

Slide 13 – Know your Child Carseat Systems

Identify how child restraint systems operate (infants, forward-facing, booster seats and lap shoulder devices), proper positioning within a vehicle and how they provide crash survival protection.

Montana Buckle Up laws – Driver is cited MCA 61-13-103. All occupants must wear a properly adjusted and fastened seat belt or child restraint. The driver is responsible for ensuring all occupants are buckling their seat belts. Children under age 6 and under 60 pounds must be buckled in a child safety seat or booster seat appropriate for their height and weights.

For details on proper installation:
<http://www.safercar.gov/TheRightSeat>

Know your Child Safety Restraint Systems



Slides 14-16 – Unbuckled Excuses

Many people give excuses for not wearing seat belts. While they may sound good they are only reasons to become exposed to risk of injury or death.

You can have the students generate a list and then discuss it or you can go through the list that is part of the PPT and discuss each point as it shows.

This could also be a student activity with a classroom worksheet where students have the opportunity to evaluate their personal beliefs and values. See resource material for more information.

Comfort - Most belts allow you to move freely and only lock when there's a sudden motion of the belt, like in a crash. Special features like comfort clips and seat belt extenders are also available. And even if that weren't the case, they'd be more comfortable than picking windshield out of your head or sitting in a wheel chair the rest of your life.

Good Drivers - On any given day, there are around 500,000 other drivers on Montana roads. Are you willing to bet your life they're as awesome at driving as you are?

Trapped- Engineers haven't figured out how to keep pavement from smashing your head or your car from rolling over you if you're not in the car. That's why you're 25 times more likely to die if thrown from your vehicle. Crashes involving fire or water happen in only 1/2 of one percent of all crashes. When they do occur the best chance of survival rests in remaining conscious, uninjured, and alert. The greatest danger is with the impact that precedes the fire or submersion in water. If you're not using a seat belt, it's very likely that you will be knocked unconscious or severely injured. If you're belted, it's very likely you will be able to unbuckle yourself and get out of a potential fire or submerged car situation

Excuses Really?

I'm only going a short distance and at low speeds.

Most vehicle crashes occur within a few miles of home.

Calculate the amount of force needed to stop your body during a crash ($\text{Weight} \times \text{Speed} = \text{Force}$).

If you weigh 120 pounds and are traveling at 30 miles per hour, 3600 pounds of force will be needed to stop your body from moving forward. ($120 \times 30 = 3600$)

Excuses Really?

Why is the government telling me what to do? It's nobody's business but my own.

If the person is never hurt in a crash, this excuse works well. Statistics show that unbelted occupants have more severe injuries, longer hospital stays, and more debilitating injuries that raise the cost of health care for everyone through increased insurance premiums, more tax dollars to fund Medicare, and jeopardize individuals' own financial security. The decision whether or not to buckle up can impact other's lives.

Excuses Really?

- *Seat belts are uncomfortable.*
- *I'm a good driver.*
- *I'm not in the habit of wearing them.*
- *I'm afraid of being trapped in a fire or under water.*

How would you respond to these excuses?



Slide 17 – With your understanding of Natural Laws and Seat Belts

Guide the students in a discussion about the excuses people make for not buckling up, the problems they see with those excuses, and the consequences of believing them.

Student Activity 2

With your new understanding of Natural Laws and Seat Belts...

- Work in groups of 3-4 students.
- Choose two excuses you have seen.
- Identify why their logic is flawed (based on your knowledge of natural laws) and what the consequences of their decision might be.

Slide 18 – Seat Belt Initiatives in Montana

Seat Belt Initiatives in Montana

- Current Usage—76.9% all roads
- Goal 2015—Increase usage to 89.3%
- How?
 - Move law from a secondary offense to primary offense
 - Targeted enforcement
 - Education—Plan2Live <http://plan2live.mt.gov/> and Buckle Up Montana <http://buckleup.mt.gov/>

Slide 19 – Everyone, every time, every drive

Everyone, every time, every drive



Click on image to start video.

Slide 20 – Now it's your turn

Now It's Your Turn

Historically, safety belt usage by teens is lower than adults. Let's change that.

- Create a message for your school that encourages drivers to make sure they and all occupants are safely buckled before the car moves.
- Create a public service announcement video that you can post on social media sites to encourage seat belt use by other teens.

Slide 21 – The car shouldn't start, 'til you cross your heart.

